भारतीय मानक
Indian Standard

IS 1079 : 2017
(Reaffirmed 2022)

तप्त बेल्लित कार्बन इस्पात की चादर, प्लेट एवं पत्ती — विशिष्टि

(सातवाँ पुनरीक्षण)

Hot Rolled Carbon Steel Sheet, Plate and Strip — Specification

(Seventh Revision)

ICS 77.140.50

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Wrought Steel Products Sectional Committee, MTD 04

FOREWORD

This Indian Standard (Seventh Revision) was adopted by the Bureau of Indian Standards, after the draftfinalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1958 and subsequently revised in 1962, 1968, 1973, 1988, 1994 and 2009. While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise it to bring in line with the present practices being followed by the industry and overseas standards of hot rolled carbon steel sheets.

In this revision the following changes have been made:

a) Chemical composition has been modified for HR0 grade and chemical compositions for new grades are added. Permissible variation for product analysis also modified;
b) Clauses **3, 6.3, 8.3.2, 12.3, 16.2** and **17** are added;
c) Clauses **1, 2, 4, 5, 6.2, 7.2, 8, 9.1.1, 13.1, 13.2, 15.1** and **16.1** have been modified;
d) New grade designation system has been adopted for new included grades;
e) Grade HR5 has been removed and these grades are included in IS 5986 : 2017 'Hot-rolled steel sheet, plate and strip for forming and flanging purposes (*fourth revision*)'.
a) Clause **10** strain ageing test has been removed.

For all the tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO standard may also be followed as an alternate method.

While revising this standard assistance has been derived from the following standards :

ISO 3573 : 2008 — 'Hot rolled carbon steel sheet of commercial and drawing qualities'
JFS A 1001 : 2014 — 'Hot rolled steel sheet and strip for automobile use'
JIS G 3113 : 2006 — 'Hot rolled steel plate, sheet and strip for automobile structural uses'
DIN EN 10111 : 2008 — 'Continuously hot rolled low carbon steel sheet and strip for cold forming'

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HOT ROLLED CARBON STEEL SHEET, PLATE AND STRIP — SPECIFICATION

(Seventh Revision)

1 SCOPE

This standard covers the requirements for hot rolled low carbon steel sheets, plates and strips intended for drawing and forming for automobile and general engineering purposes.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
228 (In various parts)	Method for chemical analysis of steel
1599 : 2012	Metallic materials — Bend test (*third revision*)
1608 : 2005	Metallic materials — Tensile testing at ambient temperature (*third revision*)
1730 : 1989	Dimensions for steel plates, sheets, strips and flats for general engineering purposes (*second revision*)
1852 : 1985	Rolling and cutting tolerances for hot rolled steel products (*fourth revision*)
1956 (Part 4) : 2013	Glossary of terms relating to iron and steel: Part 4 Flat products (*second revision*)
3803 (Part 1) : 1989	Steel — Conversion of elongation values: Part 1 Carbon and low alloy steels
8910 : 2010	General technical delivery requirements for steel and steel products
10175 : 2012	Metallic materials — Sheet and strip — Erichsen cupping test (*second revision*)
IS/ISO 16160 : 2005	Continuously hot-rolled steel sheet products — Dimensional and shape tolerances

3 TERMS AND DEFINITIONS

For the purpose of this standard, the definitions given in IS 1956 (Part 4) shall apply.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of hot rolled carbon steel sheets and strips shall conform to IS 8910.

4.2 Hot rolled carbon steel sheets and strips shall be supplied either with mill edges or flattened and shearedor trimmed/slitedges.

5 DESIGNATION AND GRADES

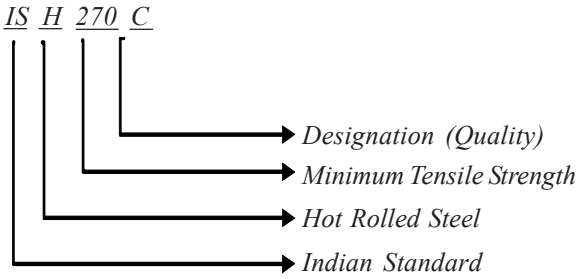
There shall be 8 grades of hot rolled carbon steel sheet and strip designated as given in Table 1.

Table 1 Designation and Grades

(*Clause* 5)

Sl No.	Grade	Designation (Quality)
i)	HR0	Ordinary.
ii)	HR1	Commercial quality intended for general fabrication purposes where sheets, or strips are used in the flat or for bending, moderate forming and welding operations
iii)	HR2	General purpose
iv)	HR3	
v)	HR4	
vi)	ISH270C	Drawing quality
vii)	ISH270D	
viii)	ISH270E	

5.1 Nomenclature for new designation and grades added is as follows:



6 MANUFACTURE

6.1 Steel shall be manufactured by any process of steel making at the discretion of the manufacturer.

6.2 Steel sheets, plates and strips shall be supplied in the rimmed, semi-killed or killed condition as agreed to between the purchaser and the manufacturer. However, HR3, HR4, ISH270D and ISH270E shall be supplied in killed condition only.

6.3 Subject to prior agreement between the manufacturer and the purchaser, a suitable protective treatment may be given to the material. Applicable type of oiling is as per Table 2.

7 CHEMICAL COMPOSITION

7.1 Ladle Analysis

Ladle analysis of the material when carried out either by the method specified in the relevant part of IS 228 or any other established instrumental/chemical method, shall be as given in Table 3. In case of dispute, the procedure given in the relevant part of IS 228 shall be the referee method.

7.2 Product Analysis

Permissible variations in case of product analysis from the limits specified in Table 3 shall be as given in Table 4.

Table 3 Chemical Composition

(*Clauses* 7.1 *and* 7.2)

Sl No.	Quality		Constituent, Percent, *Max*			
	Grade	Designation	C	Mn	P	S
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	HR0	Ordinary	0.25	2.00	0.080	0.050
ii)	HR1	Commercial	0.15	0.60	0.050	0.035
iii)	HR2	General Purpose	0.10	0.45	0.040	0.035
iv)	HR3		0.08	0.40	0.035	0.030
v)	HR4		0.08	0.35	0.030	0.030
vi)	ISH270C	Drawing Quality	0.08	0.45	0.035	0.035
vii)	ISH270D		0.06	0.40	0.030	0.030
viii)	ISH270E		0.06	0.35	0.025	0.025

NOTES

1 Steels of these grades can be supplied with the addition of micro-alloying elements like Boron, Titanium, Niobium and Vanadium either singlyor in combination and shall not exceed 0.2 percent. However, Boron addition shall be restricted to 0.006 percent maximum.

2 The nitrogen content of the steel shall not be more than 0.007 percent. For aluminium killed or aluminium silicon killed the nitrogen content shall not exceed 0.012 percent.This has to be ensured by the manufacturer by occasional check analysis.

3 When the steel is Aluminium killed, the total Aluminium content shall not be less than 0.02 percent. However, aluminium less than 0.02 percent can be mutually agreed to between the purchaser and the supplier for Aluminium killed steel. When the steel is silicon killed, the silicon content shall not be less than 0.10 percent. When the steel is Aluminium silicon killed, the silicon content shall not be less than 0.03 percent and total Aluminium content shall not be less than 0.01 percent.

4 When copper bearing steel is required the copper content shall be between 0.20 and 0.35 percent.

5 Restricted chemical composition may be mutually agreed to between the purchaser and the supplier.

Table 2 Type of Oiling

(*Clause* 6.3)

Type of Oiling		As Hot Rolled	Pickling	Skin Pass	Shot Blast
Normal Rust preventive Oil[1)]		*x*	√	*x* /√	√
Special Rust preventive Oil[2)]	High Lubrication rust preventive oil[3)]	*x*	√	*x* /√	*x*
	Solid lubricant[4)]	*x*	√	*x* /√	*x*
No Oiling		*x*	*x* / √	*x* / √	*x*

where *x* = Not applicable, √ = Applicable, and *x*/√ = Not applicable or applicable as per mutual agreement.

1) Commonly used for steel strip, plate and sheet for rust prevention.
2) Special rust preventive oil is applied to the steel sheet, plate and strip with pickling finish.
3) The rust preventive oil in combined use as press oil and rust preventive oil. This kind of oil shall be mutually agreed.
4) Solid lubricant is for better frictional properties during press work. This kind of lubricant shall be mutually agreed.

NOTES

1 Guarantee of rust prevention is depend on type of oil and quantity of oil. Purchaser should evaluate before confirming the oiling.
2 For material ordered "No Oiling", there is risk of rusting of steel. In that case, supplier has no responsibility, if oxidation/rusting occur.

Table 4 Permissible Variations for Product Analysis
(*Clause* 7.2)

Sl No.	Constituent	Percentage Limit of Constituent	Variation Over Specified Limit Percent, *Max*
(1)	(2)	(3)	(4)
i)	Carbon	≤0.15	0.02
		>0.15	0.03
ii)	Manganese	≤0.60	0.03
		>0.60 to ≤1.15	0.04
		>1.15	0.05
iii)	Sulphur	≤0.05	0.005
iv)	Phosphorus	≤0.05	0.005
		>0.05	0.010
v)	Silicon	≤0.60	0.03
		>0.60	0.06
vi)	Copper	≤0.35	0.03
vii)	Micro Alloy	-	Subject to mutual agreement between the purchaser and the supplier

NOTES

1 Product analysis shall not be applicable to rimming steel.

2 For carbon content less than 0.10 percent, variation over specified limit can be mutually agreed to between the purchaser and the manufacturer.

8 TENSILE TEST

8.1 Number of Tensile Tests

One tensile test shall be taken from each cast.

8.1.1 Where plates, sheets and strips of more than one thickness are rolled from the same cast, one additional tensile test shall be made from the material:

a) *In the case of sheets and strips (for thickness ≤ 5 mm)* — One sample shall be tested for thickness <2.0 mm, one sample shall be tested for thickness between ≥2.0 to <3.20 mm and one sample shall be tested for thickness ≥3.20 mm.

b) *In the case of plates and strips (for thickness >5 mm)* — For each variation thickness of 3 mm from the thickness of test piece first selected.

8.2 Tensile Test Pieces

The sampling position of test piece shall be at a quarter-width from the edge of the sheet and strip. If this is infeasible, the sampling should be made as close to the aforementioned position as possible.

Tensile test piece direction shall be cut transverse to the rolling direction. Longitudinal direction can be taken with mutual agreement between the supplier and the purchaser. Selection of gauge length can also be mutually agreed to between the supplier and the purchaser.

8.3 Tensile Test

When tested in accordance with IS 1608 as applicable, the mechanical properties shall be as given in Table 5 and Table 6.

8.3.1 If the percentage elongation of any test piece is less than that specified in Table 5 and Table 6, and if any part of the fracture is outside the middle half of the gauge length as scribed before the test, the test shall be discarded and a retest shall be carried out.

8.3.2 Additional product characteristics can be agreed to between the purchaser and the supplier.

Table 5 Tensile Properties
(*Clauses* 8.3 *and* 8.3.1)

Sl No.	Quality		Tensile Strength *Max*, MPa	Percentage Elongation After Fracture A, *Min*			
				$t \leq 3$		$t > 3$	
	Grade	Designation		GL $L_o = 80$ mm	GL $L_o = 50$ mm	GL $L_o = 5.65\sqrt{S_o}$	GL $L_o = 50$ mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	HR0	Ordinary	1)	1)	1)	1)	1)
ii)	HR1	Commercial	440	23	24	28	29
iii)	HR2	General Purpose	420	25	26	30	31
iv)	HR3		400	28	29	33	34
v)	HR4		380	31	32	36	37

Table 6 Tensile Properties

(*Clauses* 8.3 *and* 8.3.1)

Sl No.	Quality		Yield Strength (Yield Point/Proof Stress)[2], MPa			Tensile Strength, MPa	Percentage Elongation After Fracture A, *Min*[2]				
			$t < 2$	$2 \leq t < 3.2$	$t \geq 3.2$		$t < 2$	$2 \leq t < 3.2$	$t \geq 3.2$	$t \leq 3$	$t > 3$
	Grade	Designation					*GL* $L_o = 50$ mm			*GL* $L_o = 80$ mm	*GL* $L_o = 5.65\sqrt{S_o}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	ISH270C	Drawing Quality	170, *Min*			270-420	26	26	31	25	30
ii)	ISH270D		170, *Min*		165, *Min*	270-400	29	29	34	28	33
iii)	ISH270E		165, *Min*	155, *Min*	145, *Min*	270-380	32	32	37	31	36

NOTES for Table 5 and Table 6

1 Minimum tensile strength for qualities HR1, HR2, HR3 and HR4 would normally be expected to be 270 MPa. Where minimum tensile strength is required, the value of 270 MPa may be specified. All tensile strength values are determined to the nearest 10MPa.

2 The non-proportional test piece with a fixed gauge length (50mm), up to 5 mm thickness can be used in conjunction with a conversion table in accordance with IS 3803 (Part 1). In case of dispute, however, only results obtained on a proportional test piece will be valid for material over 3 mm in thickness.

3 Where, 't' is thickness, GL = Gauge Length, and S_o — Original cross-sectional area of gauge length.

4 The yield stress values apply to the 0.2 percent proof stress, if the yield stress is not clearly distinctive, otherwise the values apply to the lower yield stress.

5 Tensile testing is not mandatory for HR1, unless agreed to between the purchaser and the supplier.

[1] Properties on mutual agreement between the purchaser and the manufacturer.
[2] Maximum values on yield strength and elongation and/or restricted properties may be agreed to between the purchaser and the manufacturer.

9 BEND TEST

9.1 Number of Bend Tests

One bend test shall be taken from each cast.

9.1.1 Where plates, sheets and strips of more than one thickness are rolled from the same cast, one additional bend test shall be made from the following material:

a) In the case of sheets and strips (for thickness ≤ 5 mm) — One sample shall be tested for thickness <2.0 mm. One sample shall be tested for thickness between ≥ 2.0 to <3.20 mm and one sample shall be tested for thickness ≥ 3.20 mm.

b) In the case of plates and strips (for thickness >5 mm) — For each variation thickness of 3 mm from the thickness of test piece first selected.

9.2 Bend test shall be carried out in accordance with IS 1599.

9.2.1 Bend test piece shall be cut so that the axis of the bend is parallel to the direction of rolling, that is, the longer axis of the test piece shall be at 90° to the direction of rolling.

9.2.2 The test piece shall be bent cold through 180°. The internal diameter of the bend for different grades of material shall be as given in Table 7. The test pieces shall be deemed to have passed the test, if the outer convex surface is free from cracks after complete bending.

9.2.3 It is sometimes difficult to ensure that the material is accurately following the radius. In case of dispute, the test piece may be pushed into a block of lead by a former of appropriate diameter.

Table 7 Internal Diameter of Bend

(*Clause* 9.2.2)

Sl No.	Designation	Internal Diameter of Bend
i)	HR0	[1]
ii)	HR1	2t
iii)	HR2	1t
iv)	HR3	Close
v)	HR4	Close
vi)	ISH270C	1t
vii)	ISH270D	Close
viii)	ISH270E	Close

NOTE —Where't' is the thickness of test piece. Restricted internal diameter of the bend may be agreed to between the purchaser and the manufacturer.

[1] Bend test is not mandatory for HR0, however may be mutually agreed to between the purchaser and the manufacturer.

10 CUPPING TEST

10.1 Cupping test as specified in IS 10175 may be carried out only for sheets and strips of HR2, HR3, HR4, ISH270C, ISH270D and ISH270E grades having

thickness from 0.5 mm up to 2 mm, if agreed to between the purchaser and the supplier.

10.2 The cupping test values shall be agreed upon between the purchaser and the supplier.

11 RETEST

If a test does not give the specified results, two additional tests shall be carried out at random on the same lot. Both retests shall conform to the requirements of this standard; otherwise the lot shall be rejected.

12 FREEDOM FROM DEFECTS

12.1 The finished material in cut length shall be free from harmful defects which will affect the end use. When the material is supplied in the form of coils, the degree or amount of surface defects are expected to be more than in cut length sheets since the inspection of coils does not afford the same opportunity to reject the portion containing defects as with cut length. However, an excessive number of defects may be the cause for rejection. The standards for acceptance in such case can be agreed to between the purchaser and the supplier.

12.2 Edges may be mill edges or slit edges as agreed to between the supplier and the purchaser. When mill edges are specified, the depth of the defects shall be within 5 mm from the edges of the coils on both sides.

12.3 In case of sheets, plates or strip, scale pits and other minor surface defects may be removed by grinding, the depth of grinding being such that the thickness of the plate shall not go below the specified value, at the spot where dressing is done. The grinding shall be even and smooth and shall be widened enough to remove sharp ridges. Dressing with a hammer or welding of defective spots shall not be permitted.

13 DIMENSIONS AND TOLERANCES

13.1 Unless otherwise agreed to between the supplier and the purchaser, standard dimensions of hot rolled steel sheet, plate and strip shall be as specified in IS 1730.

13.2 Unless otherwise agreed the dimensional tolerances for hot-rolled steel sheet, plate and strip shall be as given in IS/ISO 16160 and as given in IS1852 for plates from plate mill and also for sizes and tolerances not covered in IS/ISO 16160.

13.2.1 Unless otherwise agreed the restricted thickness tolerances shall be as given in IS/ISO 16160.

14 CALCULATION OF WEIGHT

Material shall be supplied on the basis of actual weight. If weighing is not possible, the mass of the material shall be calculated on the basis that steel weighs 7.85 g/cm^2.

15 DELIVERY

15.1 The material may be supplied in any one (or, in combination) of the following conditions subject to mutual agreement between the supplier and the purchaser:

a) Hot rolled:
   1) As rolled,
   2) Normalizing rolling (delivery condition is +N),
b) Annealed,
c) Normalized,
d) Pickled (descaled),
e) Pickled and oiled,
f) Skin passed,
g) Skin passed and oiled, and
h) Shot blasted.

Unless and otherwise agreed, material shall be supplied in hot rolled condition (As rolled).

15.2 Subject to prior agreement between the manufacturer and the purchaser, a suitable protective treatment may be given to the material.

16 MARKING AND PACKING

16.1 Plates and **s**heets shall be supplied in bundles, and strips in coils. Each bundle shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and the manufacturer's name or trade-mark. Alternatively, top sheet/plate shall be legibly marked with the cast number or identification mark or lot number traceable to the cast number, name of the manufacturer or trade-mark.

16.2 Unless otherwise agreed the packing shall be adequate enough to ship the material safe and in good condition.

16.3 BIS Certification Marking

The material may also be marked with the Standard Mark.

16.3.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

17 ORDERING INFORMATION

While placing an order, the following are the minimum information to be specified by the purchaser:

a) Grade;
b) Size;
c) Mass of the material;
d) Total order quantity;
e) Marking instructions other than specified, if any;
f) Restricted chemistry and or properties, if used for special purpose;
g) Dimensional tolerances, if any special agreement to be made; and
h) Supply condition (edge condition, delivery conditions and type of oiling if any, etc).

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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